HIERARCHIC MODEL OF AN ESTIMATION OF THE DOCTOR'S ACTIVITY ON THE BASIS OF INFORMATION TECHNOLOGIES

Almazova E.G., Mikshina V.S.,
Serdukova N. F., Ulitina I.V.
Surgut State University,
Establishment KHMAR-Yugra "Surgut clinical skin-venereologic dispensary",
Surgut city, Russia

In the article the questions of an estimation of medical aid's quality are considered. There are offered the parameters that can be calculated with the use of the data kept in medical information systems of treatment-and-prophylactic establishment. The usage of the offered model will allow making an initial estimation of the doctor's activity without calling medical experts. Due to this method the process of estimation will be more objective, fast and less expensive.

The medical attendance quality and its quality estimation criteria occupy a greater part of native scientists' attention [1-9]. The medical care quality estimation is indicative of the attitude of the state and society to health care problems.

In Russian public health service a paradox situation has formed in medical care quality estimation: drawing attention to a patient's social protection the health care provider's social protection has been completely forgotten. Nowadays the medical staff has no motivation to upgrading at all. The medical-diagnostic process quality should have positive material confirmation [5, 6]. The labour compensation in health care service should inspire the staff personnel to medical care refinement, resources conservation, take into account the complexity and intensity of their labour costs, i.e. be of stimulating character – this is the opinion which is popular not only among medical workers, but also among their patients [7].

Currently for a medical and prophylactic institution (MPI) the following official factors are used:

for hospital service:

- bed-day plan realization percentage;
- bed turnover;
- bed mean down time;
- hospital mortality percentage;
- mean time of hospital stay, etc.

for a clinical type MPI estimation:

- number of visits;
- load on one fill vacancy of a doctor in a polyclinic;
- percentage of visits because of a disease (prophylaxis);
- plan realization percentage on preventive examinations and prophylactic immunization.

Thus, the medical service delivery can be considered not to be estimated by the official factors.

The following medical care quality estimation factors are described in literature:

1.Factors for a MPI activity estimation according the final medical result [9], such as: infant mortality, morbidity with temporal disability (MTD), etc. On the ground of definite standard indicators an integrated work efficiency factor is settled. The achievement of every factor is measured in points taking into account its value. Then, on the basis of fulfillment of all planned factors the total "efficiency indicator" is defined.

2.The treatment level quality criterion (TLQ) [10]. The essence of the TLQ method is in comparison of really rendered medical assistance with the medical economical standard. A medical expert carries out the evaluation in accordance with specially developed scales.

3.The integrated efficiency coefficient [10] which is defined by means of medical, social coefficients and the coefficient of real and standard costs correlation.

These factors are used mainly for medical assistance estimation in hospitals. When using them the involvement of experts is obligatory. It makes the process of estimation more expensive and, besides, the human factor is present here that gives rise to bias.

With information technologies development the existing in MPI medical information systems (MIS) can be successfully used at solving problems of a doctor's activity estimation. Modern MIS represent an aggregate of not only softwear and hardwear tools, but a great amount of data bases and knowledge allowing automating different processes taking course in a MPI as well. With the help of MIS an integrated information space/noosphere for the information access acceleration is created, a health care institution activity transparency and, as a consequence, the efficiency of management decisions taken increases. On the ground of the data got from MIS it is possible to get a more or less objective estimation of medical activity using methods and algorithms worked up by different authors [8, 10].

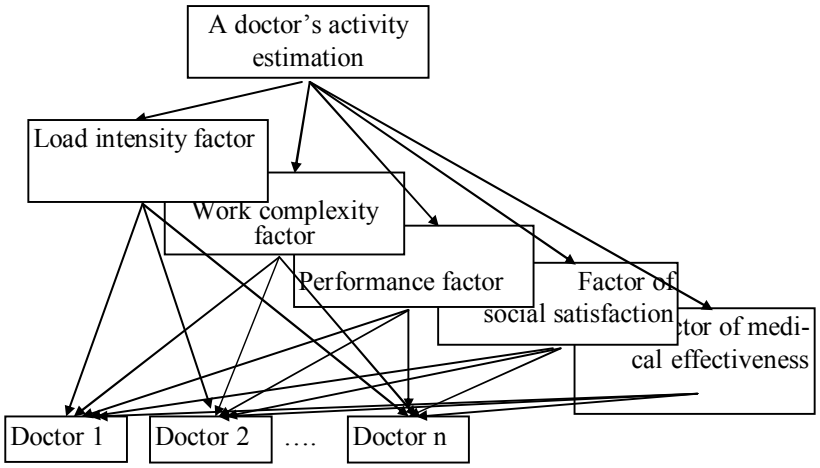
The most meaningful universal criteria of a doctor's labor activity estimation can be [8]:

- load intensity (volume of works);
- complexity of the performed work;
- quality of health care delivery;
- medical effectiveness;
- social satisfaction of the medical service consumer.

The quantity specification of a defined criterion is the corresponding factor and can be calculated on the basis of the data provided by medical information

systems. The aggregate of all factors can serve as an objective doctor's activity estimation. Naturally, the specific character of this or that MPI or its unit activity should be taken into account. In the given work we offer the criteria which were developed for the analysis of a specialized polyclinic establishment in which the data about all medical methods, rendered services, patients, etc. were cumulated in the MIS database over a period of years.

In terms of the abovementioned factors we obtained a hierarchic bilevel rating model of a medical activity estimation; it being represented in pic.1.



Picture.1. Hierarchic rating model of a doctor's activity estimation.

An integrated estimation of a doctor's activity can be obtained in terms of the following formula:

$$R_V = \nu_1 K^{Int} \cdot (\nu_2 K^{Sl} + \nu_3 K^{K} + \nu_4 K^{Mr} + \nu_5 K^{Su}) \quad (1)$$

where K^{Int} is the factor of load intensity;

K^{Sl} - the factor of the performed works complexity;

K^{K} - the factor of the performed works quality;

K^{Mr} - the medical effectiveness factor;

K^{Su} - the factor of social satisfaction of the medical service consumer; $\nu_1, \nu_2, \nu_3, \nu_4, \nu_5$ - values of weight factors determined by experts.

These values can be changed depending on the problems facing a medical and prophylactic institution in this or that period of time. Thus, a health care provider's activity control in the line of drawing his attention to some or other aspects can be exercised in a MPI.

As the factors can be measured in terms of different scales, it should be taken into account that the comparability of quantity indicators is possible only when their being standardized. Therefore, every criterion should be expressed by a ratio.

The factor of a doctor's load intensity K^{Int} serves for the estimation of the performed work amount of *i*-doctor and can be computed using the following formula:

$$K_i^{Int} = \frac{I_i^V}{\frac{1}{n}\sum_{i=1}^{n} I_i^V} \quad (2)$$

where I_i^V is the load intensity of the *i*-doctor and is defined as:

$$I_i^V = \frac{B}{T}, \quad (3)$$

B is the number of the patients treated within the analyzed period of time;

T - the actual time worked (hours) which is formed of T_1 - actual hours worked in the substantive posts; T_2 - the hours worked in the substitutive posts; T_3 - the percentage of combining the hours without working out the time (corresponds to the percentage for the enlarged service zone):

$$T = T_1 + T_2 + T_3, \quad (4)$$

The factor of the performed works complexity K^{Sl} can be computed in terms of the methods represented in the works of Shchepin O.P. with the colleagues [8]. At the heart of the methods there is a statement about the fact that the complexity of the works is connected with a doctor's labor intensity that, in its turn, is equivalent to the resource intensity of the medical diagnostic process. The tariff of the completed case medical economic standard reflects its resource intensity, inclusive of the medical activity intensity, and it means that it can be identified with the case complexity degree. Therefore, the completed case complexity factor K^{Sl} can be computed as a standard complexity factor of the *i*-doctor's performed work:

$$K_i^{Sl} = \frac{P_i}{\sum_{i=1}^{n} P_i} \quad (5)$$

where:

$P_i = \frac{\sum_{j=1}^{m} C_j^{MS}}{m}$ is the average cost of the completed cases of the *i*-doctor,

C_j^{MS} - medical economic standard *j* of that completed case;

m –the *i*-doctor's completed cases quantity;

n – the quantity of doctors as a whole.

Taking into account the fact that the current medical economic standards' tariff rates do not always correspond to either time and intellectual and physical labor costs of medical personnel, a completed case complexity factor can be estimated using expert corrections. The last are possible to develop in terms of an establishment work analysis for some previous years to cover a maximum possible number of different completed treatment cases for the generalizations' reliability. According to piling-up of materials the revision of the complexity factors estimations can be carried out.

For medical assistance quality estimation the factors are described in literature that can be divided into specific and universal ones. The specific factors are developed for every disease. This approach is considered to be rather expensive and requires a qualified expert available. The universal factors are closely connected with the health state of patients and indirectly estimate the quality of medical assistance rendered for a group of patients.

The quality estimation of rendering medical assistance is based in the whole on comparison of actually put into effect measures and the obtained results with the established "standards" or "models". Such notion as "quality standard" even exists [6]. The problem of correlation of notions "medical effectiveness" and "medical assistance quality" is rather complicated. Though the medical service quality is closely associated with the idea of medical effectiveness and lies in its foundation, these notions are not identical and, to the authors' opinion [8], it is necessary to use the factors reflecting both the result achievement degree and the characteristics of the process performed with this purpose. The factors of medical assistance quality estimation according the result, as the most objective and easy to obtain, are considered in the clause. Such estimations can serve as a method obtaining information for taking management decisions.

The factor of the performed works quality K^K.

The factor of medical assistance quality is equal to:

$$K^K = \beta_1 K^d + \beta_2 K^{sd} + \beta_3 K^{rem} + \beta_4 K^{-p}, \quad (6)$$

where K^d is the coefficient of health survey;

K^{sd} – the one of diagnosis coincidence;

K^{rem} – the remission coefficient;

K^p – the coefficient of repeated cases of visits to a doctor on one and the same nosology.

On the authors' opinion [6], the measures conducted by a doctor for a dispensary observation patient can accelerate the rehabilitation process and allow removing the patient from the dispensary list. However, if the doctor takes a decision about an unfounded removing the patient from the dispensary list, the disease progression risk will increase and the patient will have to seek for medical advice more often, that lead to his repeated including into the list or to the deterioration of another factor - the coefficient of repeated cases of visits to a doctor.

The coefficient of health survey for the i-doctor is defined

$$K_i^d = \frac{\frac{P_i^{Сд}}{P_i^{Пд}}}{1/n \sum_{i=1}^{n} \frac{P_i^{Сд}}{P_i^{Пд}}}, \quad (7)$$

where $P_i^{Сд}$ is the number of patients removed from the dispensary list for the period under review; $P_i^{Пд}$ – the number of patients included into the dispensary list for the period under review.

The coefficient of diagnosis coincidence is rather popular for medical assistance characteristics and described by many authors, but serves mainly for lethality cases characteristics. But we think that the given factor can serve for the estimation of a separate doctor activity as it allows evaluating the performed by the doctor diagnostic maneuvers which have allowed making a correct or incorrect diagnosis.

The coefficient of diagnosis coincidence for the i-doctor is equal to:

$$K_i^{sd} = \frac{\frac{N_i^{совп}}{N_i^{всего}}}{1/n \sum_{i=1}^{n} \frac{N_i^{совп}}{N_i^{всего}}}, \quad (8)$$

where $N^{совп}$ is the number of the given doctor diagnoses which have coincided with the diagnoses of the hospital with at the patient's admission to the day-and-night clinic with the MCC diagnosis, with an appointment card to the MCC, etc.;

$N^{всего}$ – the number of the diagnoses made for a time unit.

The remission coefficient shows the ratio of the time of sickness to the time of health and is one of the possible generalized characteristics of a patient's health [8]. At other equal conditions this factor can be closely connected with the doctor's work quality. A high level of corruption resistance can be expected from this factor as write-ups are impeded here, and if the doctor signed out a patient without completing the curing process, the patient soon can again seek for medical aid and the value of the considered factor will be deteriorated. Sure, the given factor depends not only on the quality of the rendered assistance, but also on a range of external causes (age, life mode of the patient and others), but it can be expected that owing to the law of large numbers random factors will become neuter, and the difference between the factors will be explained by the doctor's personality traits.

The remission coefficient shows how effective the performed treatment of the patients by the i-doctor is.

$$K_i^{rem} = \frac{1/m \sum_{i=1}^{m} \frac{T_i^{болезни}}{T_i^{здоровья}}}{1/n \sum_{j=1}^{n} \left(1/m \sum_{i=1}^{m} \frac{T_i^{болезни}}{T_i^{здоровья}} \right)} \quad (9)$$

where $T^{болезни}$ is the amount of time from the moment of visiting the doctor for the first time up to the termination of the treatment course (a completed case);

$T^{здоровья}$ – the amount of time after the termination of the treatment course up to the next visit to the doctor because of a sickness;

n – the number of the polyclinic doctors;

m – the number of the i-doctor's patients.

The coefficient of repeated cases of visits to a doctor on one and the same nosology shows how well the treatment was carried out and how seldom backsets occur.

$$K_i^p = \frac{\frac{N_i^{повт.сл.}}{N_i^{всего}}}{1/n \sum_{i=1}^{n} \frac{N_i^{повт.сл}}{N_i^{всего}}}, \quad (10)$$

where $N^{повт.сл}$ – is the number of repeated cases of visits during the year because of one and the same disease (is computed for the patients who are not in the dispensary list);

$N^{всего}$ – the number of completed cases for a given doctor for a time unit.

The weight numbers were offered by experts depending on what role this or that factor plays in medical assistance quality.

The medical effectiveness factor K^{Mr}

$$K_i^{Mr} = \frac{((K_i^r + K_i^l + K_i^g)/3)}{1/n \sum_{i=1}^{j} \left((K_i^r + K_i^l + K_i^g)/3\right)}, \quad (11)$$

where $K^r = \frac{N_{улучш}}{N}$ – is the coefficient showing the ratio of positive treatment results to the total quantity of patients;

$K^l = \sum_{n=1}^{m} \frac{T_n^{факт}}{T_n^{станд}}$ – the coefficient showing the ratio of the number of the hospitalized by a given doctor to the total number of the cured patients.

The factor of social satisfaction K^{Su} can be valued according to the results of patients' special interview:

$$K_i^{Su} = \frac{1}{\sum_{i=1}^{n} \frac{B_i^{удовл}}{B_i^{опр}}} * \frac{B_i^{удовл}}{B_i^{опр}} \quad (12)$$

where $B_i^{удовл}$ is the number of the signed out patients satisfied with the quality and culture of their i-doctor of a concrete department;

$B_i^{опр}$ - the number of the interviewed patients finished the treatment of the *i*-doctor of a given department.

For computing the offered factors using SQL-query the data from the medical information system of one of Surgut medical institutions were got. The database fields necessary for extracting information used further for computing the factors are represented in the table 1.

In table 2 the results of computing of nine factors of activity factors for 7 doctors according to the data of the medical information system of one of Surgut medical institutions of the polyclinic type are quoted. On the ground of the computed factors a generalized factor of a doctor's activity is quoted in the last heading.

For the composite index computation the importance weight coefficients of this or that factor, defined by experts, should be used. As the experts the leaders of the medical institution can act. In this very work the factors importance weight coefficients were recognized as equal against each other. On the ground of the computations a conclusion can be done, that the best results belong to Doctor 5, Doctor 6, Doctor 7 and Doctor 1.

Depending on the problems facing a medical institution in a concrete period of time the factors' importance can be changed. Thus, the leadership of a medical institution has got a management instrument permitting it to aim the efforts of the collective body at the performance of some or other problems.

Table 1. The necessary database fields for computing the factors

Factor		*Interpreted database fields*	*Extracted information*
Factor of load intensity	K_i^{Int}	Code of doctor Code of patient Date of visit Worked out time (number of wages)	Total number of completed cases Worked out time (including substantive posts, substituted posts, percentage of combination hours without working out the time).
Complexity factor	K^{Sl}	Code of doctor Code of patient Date of visit Sum to pay	Cost of completed case on j-nosology for i-doctor (actual) Integrated cost of doctor's work Integrated cost of work of all doctors
Factor of the performed works quality	K^d – health survey	Code of doctor Code of patient Date of visit Dispensary list (1- included, 2- signed in , 3- signed out)	Number of the signed in for a period of time Number of the signed out
	K^{sd} – diagnoses coincidence coefficient	Code of doctor Code of patient Date of visit Initial diagnosis Terminal diagnosis	Number of coincident initial and terminal diagnoses Number of visits
	K^{rem}– remission coefficient	Code of doctor Code of patient Date of visit	Duration of sickness (days), duration of health state (period of time from disease to disease)
	K^p– coefficient of repeated cases of visits	Code of doctor Code of patient Date of visit	Number of patients, having visited because of one and the same diagnosis for the second, third, etc. time for a period of time Total number of attendances for a period of time
Factor of medical effectiveness	K^r – coefficient of visit results	Code of doctor Code of patient Date of visit Result of visit	Number of positive results of completed case, total number of visits
	K^l – coefficient of treatment duration	Code of doctor Code of patient Date of visit Date of completed case termination Treatment duration according to standard	Ratio of treatment duration to standard treatment duration for completed cases
	K^g – coefficient of hospitalization	Code of doctor Code of patient Date of visit Result of visit	Number of patients admitted to a hospital, total number of treated patients
Factor of social satisfac-	K^{Su}		Number of patients satisfied with treatment quality of i-doctor to total number of interviewed patients of i-doctor

References:

1.Vyalkov A.I. Quality control in public health service // Problems of public health service management. – 2005 - №1 – pp. 5-12.

2.Grinenko A.Ya., Trishin V.M. Using Gallup polling for taking managerial decisions in public health service // Problems of public health service management. – 2003 - №3 – pp. 38-40.

3.Orekhova G.G., Babenko A.I. Opinion of parents on the organization of medical aid for children having suffered from birth injuries // Problems of public health service management. – 2003 - №5 – pp. 59-61.

Table 2. A doctor's activity factor

	Quality factor						Effectiveness factor			
	Intensity factor	Complexity factor	Coefficient of health survey	Coefficient of diagnoses coincidence	Remission coefficient	Coefficient of repeated cases of visit	Coefficient of visit results	Coefficient of hospitalization	Coefficient of treatment duration	Composite index of medical aid rendering quality estimation
Doctor 1	0,90	0,06	0,86	0,82	0,09	0,16	0,65	0,01	0,91	1,50
Doctor 2	0,86	0,08	0,90	0,75	0,01	0,22	0,58	0,01	0,99	1,28
Doctor 3	0,79	0,07	0,85	0,91	0,01	0,18	0,54	0,02	1,01	1,26
Doctor 4	0,72	0,18	0,92	0,84	0,01	0,19	0,64	0,03	0,89	1,24
Doctor 5	1,13	0,07	0,84	0,82	0,01	0,17	0,76	0,02	1,10	1,94
Doctor 6	0,94	0,10	0,90	0,82	0,22	0,16	0,70	0,04	0,99	1,77
Doctor 7	1,01	0,09	0,45	0,81	0,01	0,20	0,66	0,14	0,99	1,51

4.Romanenko M.G., Babenko A.I. Societal estimation of Marninsk central Ulus hospital of the Republic of Sakha (Yakutia) by its personnel // Problems of public health service management. – 2003 - №5 – pp. 50-53.

5.Kucherenko V.Z., Yakovlev V.P., Kudryavtsev Yu.N., Trofimov A.S. Some approaches to medical-diagnostic process quality estimation // Problems of public health service management. – 2003 - №1 – pp. 13-17.

6.Yakovlev V.P., Kudryavtsev Yu.N., Trofimov A.S. Modern tendencies in medical staff types of wages development // Public health service economics. - 2003. - №7. – pp. 22-24.

7.Kovarov R.N., Komarov N.V. Interviews of doctors and patients on medical aid quality estimation criteria working on remuneration of labour // Problems of public health service management. – 2005 - №3 – pp. 85-88.

8.Shchepin O.P. Methodological foundations and mechanisms of medical aid quality supply / Shchepin O.P., Starodubov V.I., Lindenbraten A.A., Galanova G.N. – M.: Medicine, 2002. – p.176:Il.

9.Antipova N.P., Baidakova N.N., Baryshev S.V., Blandinsky V.F., Grebeshkova L.L., Gruzdeva I.I., Kaikovai L.V., Maiorov M.I., Chernetsom V.A. Analytical report "Analysis of public health service system control in Yaroslavl region", Project TASIS "Russian Federation: public health service system control support", Moscow, 1999.

10. Dyachenko V.G. Report on grant Expert evaluation of medical aid quality. Electronic resource http://www.health.gov.ua

The article is admitted to the International Scientific Conference " Present-day problems of science and education"; Horvatiya (Pula), July 7-14, 2007 г.; came to the editorial office on 14.06.07

CARBON DIOXIDE LASER USING EXPERIENCE IN HYPERTROPHIC SCARS TREATMENT

Alfyorov N.N., Chemodanova I.D.
Road clinic hospital, St. Irkutsk-Passazhirsky ESRW Irkutsk, Russia

Cicatrical defects on people's skin are ones of the most common pathologies in the world. On evidence of different authors up to 19% of all patients applied to medical institutions are with hypertrophic scars. Scar problem is of current interest as active working age young people suffer from them.

The purpose of the present work is to study a combined use of hypertrophic skin scars treatment by cryodestruction and CO_2-laser.

The method was used in 17 patients aged from 17 to 35 years old with hypertrophic skin scars from 1 to 5 years old. The patients with the scars were divided into groups according to the scar size. All the patients had linear form of scar. First, high-powered (15- 25 Watts) polishing with CO_2-laser of the most extruded scar portions in continuous beaming mode up to formation of thermal necrosis zone was performed. During the operation the power can be changed for some times. The marking is the tissue color local alteration, i.e. thermal necrosis in the center and the tissue blanching on the edge with ablative deformity. Then within the period from one to three days cryodestruction was carried out. The choice criterion was the termination of so-called "capillary whirl" circum the area of thermal necrosis. For cryodestruction exercise liquid nitrogen was applied. The manipulation is performed extremely quickly, in one movement, carefully taking the scar without touching the boundary zone which has a so-called "verge". Then germfree drapes with liberal amount of acerbine are overlapped.